

Please ADD claims 23 and 24 as follows:

-- 23. An exposure apparatus comprising:

a projection optical system for projecting a pattern of a reticle onto a substrate by using an exposure beam;

a diaphragm having an opening for the exposure beam in a center of said diaphragm, said diaphragm setting a numerical aperture of said projection optical system by adjusting the opening; and

a mechanism which removes heat of said diaphragm, wherein the mechanism includes a heat removing device located between the opening and an outer edge of the diaphragm.

24. A device manufacturing method comprising the steps of:

exposing a pattern onto a substrate using the exposure apparatus recited in claim 23; and

~~developing the substrate on which the pattern is exposed. --~~

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

To place the subject application in better form, the specification has been amended to correct minor informalities, including those noted by the Examiner. No new matter has been added by these changes.

Claims 1-24 are presented for consideration. Claims 1, 12, and 23 are independent. Claims 1, 6 and 12 have been amended to clarify features of the invention, while claims 23 and 24 have been added to recite additional features of the invention. Support for these changes can be found in the application, as filed. Therefore, no new matter has been added.

Applicants request favorable reconsideration and withdrawal of the objection and rejections set forth in the above-noted Office Action.

The specification was objected to on formal grounds. Applicants submit that the foregoing changes overcome this objection. Such favorable indication is requested.

Claims 1-4, 6-8, 11-15, 17-19 and 22 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,530,518, to Ushida et al., in view of U.S. Patent No. 6,020,950, to Shiraishi. Claims 5, 9, 10, 16, 20 and 21 were rejected under 35 U.S.C. §103 based on this art combination and further in view of U.S. Patent No. 5,894,341, to Nishi et al. Applicants submit that the cited art does not teach many features of the present invention, as recited in claims 1-24. Therefore, these rejections are respectfully traversed.

In one aspect of the invention, independent claim 1 recites an exposure apparatus that includes a projection optical system which projects a pattern of a first object to a second object by using an exposure beam in order to transfer the pattern from the first object onto the second object, a diaphragm having an opening for the exposure beam in the center of the diaphragm, the

diaphragm setting a numerical aperture of a projection optical system by adjusting the opening, and a mechanism which keeps a temperature of the diaphragm substantially constant during an exposure operation by the projection optical system, the mechanism including a heat removing device located between the opening and an outer edge of the diaphragm.

In another aspect of the invention, independent claim 12 recites a micro-device manufacturing method that includes projecting, through a projection optical system, a pattern of a reticle to a wafer by using an exposure beam, in order to transfer the pattern from the reticle onto the wafer, setting, using a diaphragm, a numerical aperture of the projection optical system by adjusting an opening for the exposure beam centered in the diaphragm, keeping a temperature of the diaphragm substantially constant, during an exposure operation by the projection optical system, using a heat removal device located between the adjustable opening and an outer edge of the diaphragm, and manufacturing a micro-device from the wafer.

In still another aspect of the invention, independent claim 23 recites an exposure apparatus that includes a projection optical system for projecting a pattern of a reticle onto a substrate by using an exposure beam, a diaphragm, having an opening for the exposure beam in the center of the diaphragm, the diaphragm setting a numerical aperture of the projection optical system by adjusting the opening and a mechanism which removes heat of the diaphragm, the mechanism including a heat removal device located between the opening and an outer edge of the diaphragm.

By such an arrangement, the present invention provides the ability to remove heat to be generated in a projection optical system to a desired extent and to stabilize imaging ability of

the projection optical system even if the numerical aperture of the projection optical system varies.

Applicants submit that the cited art does not teach or suggest such features of the present invention, as recited in the independent claims.

The Ushida et al. patent relates to a projection exposure apparatus that includes an illuminating optical device for illuminating a projection negative and a projection optical device for projection-exposing the projection negative illuminated by the illumination optical device onto a substrate. The Ushida et al. patent, however, fails to teach or suggest any heat removing mechanism in the manner of the present invention recited in the independent claims.

Applicants submit that the remaining art cited does not cure the deficiencies noted above with respect to the Ushida et al. patent.

The Shiraishi '950 patent relates to an exposure method and a projection exposure apparatus in which a light-shielding plate has a set of fixed peripheral openings with a fluid path through the center of the plate. Applicants submit, however, that this teaching does not cure the deficiencies noted above with respect to the Ushida et al. patent. Therefore, the Shiraishi '950 patent adds nothing to the teachings of the Ushida et al. patent that would render obvious Applicants' present invention as recited in the independent claims.

The Nishi et al. relates to an exposure apparatus and a method for measuring a quantity of light with temperature variations. The Examiner relies on this patent for teaching an aperture having an iris diaphragm and a turret with a plurality of openings. Applicants submit,

however, that the Nishi et al. patent, as with the remaining art discussed above, does not teach or suggest the salient features of Applicants' present invention, as recited in the independent claims.

For the foregoing reasons, Applicants submit that the present invention, as recited in independent claims 1, 12 and 23, is patentably defined over the cited art, whether that art is taken individually or in combination.

The dependent claims also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,

  
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